

U.S. Patent Application Serial No. 10/532,249  
Response filed October 23, 2007  
Reply to OA dated June 26, 2007

**REMARKS**

Claims 1-23 are pending in this application. Claim 7 is amended herein. Upon entry of this amendment, claims 1-23 will be pending. Entry of this amendment and reconsideration of the rejections are respectfully requested.

No new matter has been introduced by this Amendment. The amendment to claim 7 only corrects a typographical error introduced in the Preliminary Amendment dated April 22, 2005.

**Claims 1, 4, 5 and 9-12 are rejected under 35 U.S.C. §103(a) as being unpatentable over Takeshi et al. (Abstract JP8186235) in view of Mirkarimi et al. (U.S. Patent No. 6,396,094).**  
(Office action paragraph no. 3)

The rejection is respectfully traversed, and reconsideration is requested.

The invention of the application is characterized by (a) using a ferroelectric thin film capacitor section having (111) orientation, which is intended to be used in an FRAM, and (b) separately preparing a ferroelectric thin film capacitor section having (111) orientation and a transistor section, and then bonding them together.

Cited reference JP 8-186235 A describes preparing separately a memory capacitor section and a transistor section, and bonding them for unification. However, this reference is directed to, in particular, a method for manufacturing a semiconductor device useful for the production of a dynamic memory (DRAM) (see, for example, paragraph [0001]), rather than an FRAM. This

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reference does not refer to crystallinity and crystal orientation in a memory capacitor, which shows that an FRAM is not envisaged by this reference.

Secondary reference Mirkarimi US 6,396,094 relates to an FRAM, and uses (111) orientation of rhombohedron crystal. However, this reference is silent on separate preparation of a capacitor section and a transistor section followed by bonding thereof.

Thus, JP'235, which is directed to a DRAM rather than an FRAM, is not related to a semiconductor device comprising a capacitor using ferroelectricity of a thin film, is silent on the crystallinity and crystal orientation of a thin film used, and is also silent on a plane orientation of a thin film used, and is also silent on a plane orientation of an electrode. On the other hand, although Mirkarimi '094 is directed to an FRAM, it is silent on separate preparation of a capacitor section, which has (111) orientation parallel with the surface of a substrate (electrode), and a transistor section, followed by bonding thereof. The combination of the two references neither teaches nor suggests the invention of the application. Accordingly, claims 1, 4, 5 and 9-12 are not obvious over JP '235 and Mirkarimi '094, taken separately or in combination.

**Claim 2 is rejected under 35 U.S.C. §103(a) as being unpatentable over Takeshi et al. (Abstract JP8186235) in view of Mirkarimi et al. (U.S. Patent No. 6,396,094), and further in view of Adkisson et al. (U.S. Patent No. 6,333,202). (Office action paragraph no. 4)**

The rejection is respectfully traversed, and reconsideration is requested.

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In the rejection, JP '235 and Mirkarimi '094 are cited as in the rejection of base claim 1, and Adkisson is cited as disclosing the limitation of dependent claim 2. However, as discussed above, Applicant submits that the combination of JP '235 and Mirkarimi '094 does not provide the limitations of base claim 1, and Applicant submits that Adkisson does not disclose or suggest the limitations of claim 1 not found in JP '235 and Mirkarimi '094.

**Claim 6 is rejected under 35 U.S.C. §103(a) as being unpatentable over Takeshi et al. (Abstract JP8186235) in view of Mirkarimi et al. (U.S. Patent No. 6,396,094), and further in view of Kim et al. (U.S. Patent Application Publication No. 2003/0103371 A1). (Office action paragraph no. 5)**

The rejection is respectfully traversed, and reconsideration is requested.

In the rejection, JP '235 and Mirkarimi '094 are cited as in the rejection of base claim 1, and Adkisson is cited as disclosing the limitation of dependent claim 6. However, as discussed above, Applicant submits that the combination of JP '235 and Mirkarimi '094 does not provide the limitations of base claim 1, and Applicant submits that Kim does not disclose or suggest the limitations of claim 1 not found in JP '235 and Mirkarimi '094.

In addition, the Examiner cites Kim et al. for disclosing a ferroelectric capacitor wherein the substrate is MgO. The Examiner states that it would have been obvious to use the MgO substrate of Kim as the substrate in JP '235 because MgO is a conventional substrate used with PZT material due to its similar lattice constant.

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However, in Kim et al., substrate 11 is MgO with a TiO<sub>y</sub> layer (paragraph [0037]), Pt electrode lines and pads 12 are on this substrate, and PZT layer 13 is on top of this. Kim's substrate, therefore, is **not** a MgO single crystal, and the Examiner has not provided this limitation of claim 6.

Moreover, Kim et al. does **not** appear to state that MgO is used with PZT "due to its similar lattice constant," as the Examiner maintains. This motivation stated by the Examiner appears to have been derived as hindsight from the present specification.

Claim 6 is therefore not obvious over the cited references, taken separately or in combination.

**Claim 7 is rejected under 35 U.S.C. §103(a) as being unpatentable over Takeshi et al. (Abstract JP8186235) in view of Mirkarimi et al. (U.S. Patent No. 6,396,094), and further in view of Greenwald et al. (U.S. Patent No. 5,070,026). (Office action paragraph no. 6)**

The rejection is respectfully traversed, and reconsideration is requested.

In the rejection, JP '235 and Mirkarimi '094 are cited as in the rejection of base claim 1, and Greenwald is cited as disclosing the limitation of dependent claim 7. However, as discussed above, Applicant submits that the combination of JP '235 and Mirkarimi '094 does not provide the limitations of base claim 1, and Applicant submits that Greenwald does not disclose or suggest the limitations of claim 1 not found in JP '235 and Mirkarimi '094.

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In addition, Applicant submits that the Examiner has not provided a proper basis in fact and/or technical reasoning that plane (0001) would be inherent in Greenwald's substrate 22, which can be sapphire.

In addition, in Greenwald et al., substrate 12 is covered by conductive layer 14 (column 4, lines 16-24), which is a noble metal or conductive oxide such as  $\text{SnO}_2$  or  $\text{InSnO}_2$ . Integrated circuit 24 is formed on substrate 22 (column 4, lines 48-49). There appears to be no motivation for substituting this alumina or sapphire substrate for substrate 2 in JP '235.

**Claim 8 is rejected under 35 U.S.C. §103(a) as being unpatentable over Takeshi et al. (Abstract JP8186235) in view of Mirkarimi et al. (U.S. Patent No. 6,396,094), and further in view of Yamawaki et al. (U.S. Patent No. 5,037,774). (Office action paragraph no. 7)**

Therejection is respectfully traversed, and reconsideration is requested.

In the rejection, JP '235 and Mirkarimi '094 are cited as in the rejection of base claim 1, and Yamawaki is cited as disclosing the limitation of dependent claim 8. However, as discussed above, Applicant submits that the combination of JP '235 and Mirkarimi '094 does not provide the limitations of base claim 1, and Applicant submits that Yamawaki does not disclose or suggest the limitations of claim 1 not found in JP '235 and Mirkarimi '094.

In addition, Yamawaki et al. is cited for the disclosure of a  $\text{MgAl}_2\text{O}_4$  substrate, citing substrate 1 in Fig. 4 of the reference. However, substrate 1 is (100) silicon (column 1, line 38). The reference refers to use of sapphire ( $\alpha\text{-Al}_2\text{O}_3$ ) as an insulating material on which a **silicon** active layer

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will be deposited (column 1, lines 14-25) to make a silicon-on-insulator device. There is no motivation to combine this with JP '235, or any motivation to deposit PZT on top of the sapphire.

**Claims 13-18 and 20-22 are rejected under 35 U.S.C. §103(a) as being unpatentable over Takeshi et al. (Abstract JP8186235) in view of Mirkarimi et al. (U.S. Patent No. 6,396,094), and further in view of Li (U.S. Patent Application Publication No. 2001/0006254 A1). (Office action paragraph no. 8)**

The rejection is respectfully traversed, and reconsideration is requested.

In the rejection, JP '235 and Mirkarimi '094 are cited as in the rejection of base claim 1, and Li is cited as disclosing the limitation of dependent claims 13-18 and 20-22. However, as discussed above, Applicant submits that the combination of JP '235 and Mirkarimi '094 does not provide the limitations of base claim 1, and Applicant submits that Li does not disclose or suggest the limitations of claim 1 not found in JP '235 and Mirkarimi '094.

In addition, Li discloses forming Ir and Rh thin films epitaxially on an MgO buffer layer. PZT and PLZT are discussed in paragraphs [0004] and [0005], and epitaxial growth of a PZT thin film on the epitaxial Ir thin film is disclosed in paragraph [0042]. However, this appears to be only applicable to forming PZT films on the epitaxial Ir and Rh, and there is no suggestion or motivation to substitute the substrate 2 of JP '235 with epitaxial Ir or Rh.

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**Claims 19 and 23 are rejected under 35 U.S.C. §103(a) as being unpatentable over Takeshi et al. (Abstract JP8186235) in view of Mirkarimi et al. (U.S. Patent No. 6,396,094), further in view of Li (U.S. Patent Application Publication No. 2001/0006254 A1), further in view of Lee et al. (U.S. Patent No. 5,940,705) (Office action paragraph no. 9, page 8)**

This rejection is respectfully traversed, and reconsideration is requested.

In the rejection, JP '235 and Mirkarimi '094 are cited as in the rejection of base claim 1, and Lee is cited as disclosing the limitation of dependent claims 19 and 23. However, as discussed above, Applicant submits that the combination of JP '235 and Mirkarimi '094 does not provide the limitations of base claim 1, and Applicant submits that Lee does not disclose or suggest the limitations of claim 1 not found in JP '235 and Mirkarimi '094.

**Claim 3 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. (Office action paragraph no. 9, page 10)**

Since Applicant has traversed the rejection of base claim 1, Applicant has not amended claim 3.

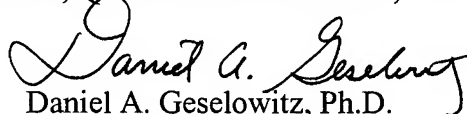
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If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact the Applicant's undersigned agent at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, the Applicant respectfully petitions for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

KRATZ, QUINTOS & HANSON, LLP



Daniel A. Geselowitz, Ph.D.

Agent for Applicant

Reg. No. 42,573

DAG/xl

Atty. Docket No. **050256**  
Suite 400  
1420 K Street, N.W.  
Washington, D.C. 20005  
(202) 659-2930



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PATENT TRADEMARK OFFICE

Enclosure: Petition for Extension of Time

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